A history of sustainable progress

Vanderbilt University
Combined Heat and Power Plant
The Beginning - 1888
The original Mechanical Engineering Hall was built in 1888.

It was the first school in Tennessee designed for teaching engineering.

From 1888 to 1925 its boiler provided steam for the heating of all campus buildings.

From 1898 to 1918 its generator produced electricity for the campus.

A plaque is mounted outside the “Old Mechanical” Building which describes its history.
"OLD MECHANICAL"

When the Vanderbilt building of which this structure was the principal part was erected in 1886, it was the first in Tennessee designed for the teaching of engineering. Its long career has since then been one of varied service to the whole University.

From 1888 to 1923 its boilers supplied steam for heating other campus buildings and from 1898 to 1918 its generators produced electricity for the campus. Through 1926 its basement provided a dressing room for athletic teams that played on the first Dudley Field, just to the north. Quartered in the building at times have been the Vanderbilt Army ROTC unit, the departments of religious studies and of drama and speech, the sailing club, an amateur radio station, and storage facilities for the department of geology, the naval ROTC unit, and plant operations.

In 1982, the new building for the Owen Graduate School of Management was completed and the main section of "OLD MECHANICAL" was converted to a new life of Vanderbilt service.

September 1982
The Second Generation

- Between 1925 and 1927, a new power plant was constructed at its current location (between Featheringill Hall and the Branscomb Quad). This power plant originally had four coal-fired boilers.
- In 1962 it was expanded by adding two more boilers.
- In 1980 a fabric filter bag house was installed to capture particulates from boiler exhaust gas.
- VU’s coal ash has been used as an additive to mulch and most recently as an ingredient in cement mix.
Power Plant Operations Prior to 1960

Construction of the tall stack, April 1962

Construction of a boiler, April 1962
The Third Generation - 1988
Current Combined Heat and Power Plant
In 1988, the four boilers that were installed in the 1920’s were removed and replaced with three new coal-fired boilers.

One of the two boilers installed in 1962 was converted to an all natural-gas boiler. The remaining boiler from 1962 was idled (and later removed in 2006).

Peabody Campus was connected to the main power plant in 1988. Prior to that time, Peabody College had its own boilers located at Mayborn Hall. The Peabody boilers were installed in the 1920s.
Backpressure Turbines Installed

Steam from the boilers is directed into a backpressure turbine that acts as a pressure reducing station, taking in steam at 650 pounds per square inch (PSI) and reducing it to a usable 75 PSI.

While reducing pressure, the turbine produces up to 7,000 kilowatts of electricity.
Backpressure Turbine
Condensing Turbine

A condensing turbine was also installed to ensure maximum performance of the boilers at full load while creating an additional 4.5 megawatts of electricity.
Condensing Turbine
In 1993, the Central Chilled Water Plant was added to the power plant.

Three steam-powered chillers in the main power plant provide chilled water for use throughout the campus.
Central Chilled Water Plant - 1993
Generation 3.5
Natural Gas Turbines Installed in 2000
Natural Gas Turbine Engines

- Two General Electric Natural Gas Turbines were installed in 2000.
- The turbines doubled power plant energy generation, creating 10,000 kilowatts of electricity and 100,000 pounds of steam.
- Heat Recovery Steam Generators (HRSGs) were added to each turbine; HRSGs use heat from turbine exhaust to generate more steam & electricity.
Natural Gas Turbine Engine
Electrical Generator
Heat Recovery Steam Generators [HRSGs]
Solar Panels added in 2011

- An 8 kilowatt, student-initiated solar thin film installation was installed on the concrete silo at the Co-generation power plant. This is the first solar application on Vanderbilt’s campus.

- Two Vanderbilt engineering students proposed a solar panel installation as part of the inaugural Vanderbilt Green Fund (VGF). The proposal was considered by a selection committee of faculty, staff and students as the best out of the 24 received, and the project received $55,000 in funding. The panels were activated in October 2011.
With the addition of the gas turbine plant, Vanderbilt University has diversity in power generation. Vanderbilt can produce energy by using coal or natural gas, and a small amount by solar. This allows VU to acquire the best market prices on coal or natural gas. Our vendors are aware of our diversity and work to provide us the lowest prices for our fuel. This cost savings are passed on to the University community.
STEAM is used at VU to:

- Heat buildings
- Provide hot water
- Operate the VU Hospital autoclaves
- Sterilize equipment
- Run experiments
- Power chilled water units
Chilled Water is used for:

- Cooling buildings/air conditioning
- Removing humidity from buildings
- Cooling equipment
Electricity is used for:

- Lighting
- Air conditioning
- Computers, office equipment, and servers
- Medical Devices
- Elevators
- Fire & Security Systems
- Lab Equipment
- Food preparation
VU’s Power Plant production: 75,845,531 kwh
Electricity Purchased from NES: 303,543,739 kwh
Total amount of electricity consumed at Vanderbilt: 379,389,270 kwh

Metric Tons (MT) of Greenhouse Gas (GHG) emissions associated with:

Electricity purchased from NES: 183,857 MT
Coal consumed at VU: 92,090 MT
Natural Gas consumed at VU: 62,835 MT
Total GHGs from Power Use: 338,782 MT
What if ... Vandy purchased all our electricity and only produced steam

If steam was produced using only coal as fuel...

GHGs from electricity purchases: 229,797 MT
GHGs from coal (for steam): 244,854 MT
Total GHG output: 474,651 MT

474,651 MT - 338,782 MT = 135,869 MT

GHG emissions would increase by almost 136,000 MT
What if … Vandy purchased all our electricity and only produced steam if steam were produced using only natural gas as fuel…

GHGs from electricity purchases: 229,797 MT
GHGs from natural gas (for steam): 133,809 MT
Total GHG output: 363,606 MT

363,606 MT – 338,782 MT = 24,824 MT

GHG emissions would still increase by almost 25,000 MT
What if … The Power Plant shut down?

If VU were to purchase all its energy from NES, in the form of electricity, the GHG output to make that electricity would be

678,413 Metric Tons

…instead of 338,631 Metric Tons by using the power plant.

GHG emissions from our power consumption would double – an increase of almost 340,000 Metric Tons!